

## "ADVERSE WEATHER IMPACT ON AVIATION SAFETY, INVESTIGATION AND OVERSIGHT"

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Good evening, ladies and gentlemen. I am deeply honored to represent the more than 5,000 dedicated young men and women who serve humanity as pilots and aircrewmembers in the United States Coast Guard. I'd like to spend the next thirty minutes telling their story by borrowing on my own experiences. I hope to be able to entertain and inform you. I don't have a heavy message to impart, but I'll close my talk with a few personal observations which do not necessarily represent the official views of the United States Coast Guard.

Before I begin, let me acquaint you with a few facts about my uniform, which will help you to enjoy one of my "sea stories". I wear the naval aviator's "wings of gold", as do all Coast Guard pilots, regardless of their source of training. I also own a bunch of service ribbons, or what we call "gedunk" ribbons (expert rifle and pistol, "I was alive in '65", unit commendations, and so forth). I've never been to a shooting war. I suppose the only enemy I've ever confronted in aviation was weather. I have, on two occasions, been the recipient of the Air Medal for "meritorious achievement in aerial flight" in action against the weather enemy. In retrospect, I'm not sure the Coast Guard should decorate those who have tilted at such windmills. We may be encouraging a "Deer Hunter" mentality among these airmen.

I'll have to admit that I'm very nervous, surrounded by such an awesome assemblage of scientists, aviation industry representatives, and managers of the National Airspace System Plan. I've literally wracked my brain for a good weather joke to use as an "icebreaker", but I came up empty-handed. Instead, I thought maybe I'd relate an incident which occurred several years ago up in Alaska. It's a true story, there's a moral, and I can laugh about it...now.

Once upon a lonely mid-winter night, a U. S. fishing vessel broadcast a MAYDAY, reporting a steering casualty which seemed to indicate that within a few hours the boat would be driven onto the north shore of Unimak Island by an intense Aleutian storm. A C-130 aircraft, piloted by a close friend of mine, quickly departed from USCG Air Station Kodiak to locate the distressed vessel, stand ready to airdrop survival equipment, and act as a "pathfinder" for my helicopter.

My co-pilot and I carefully planned the 450-mile non-stop flight from Kodiak to the scene, silently thankful that the well-equipped airport at Cold Bay was within 50 miles of the vessel and would be our ultimate destination. Weather conditions and darkness combined to paint a bleak picture. After takeoff from the tiny haven of our base, the HH-3F seemed to be swallowed up by the forces of nature; we were in the belly of the whale. Our route of flight took us south of the Aleutian chain, island-hopping from Kodiak to the Trinities, past the Semidis to the Shumagins at altitudes below 1,000 feet to avoid airframe ice. A strong, north-west gusting wind produced moderate and occasionally severe turbulence. Eye fatigue encountered in scanning the flight and engine instruments prevented either of us from flying for more than a half hour at a time. Snow showers filled our radar scope and occasionally obliterated echoes from nearby land masses. A ninety-mile open ocean leg of our trackline required DR navigation, since LORAN A coverage of the area was inherently poor. It seemed like an eternity before we acquired those islands on radar.

After about two hours, I became intrigued by occasional glimpses of moonlight and stars through "holes" in the overcast. My curiosity overwhelmed me, and I asked my buddy in the "herk" what type of flight conditions he was experiencing upstairs. He said he had broken out at 6,000 feet into "VFR on top", and had established an orbit over the distressed vessel at 10,000 feet.

I felt certain that we could escape the incessant jolting by mechanical turbulence if it were possible to climb above the "lee" of the Aleutian terrain. The C-130 obtained our clearance from Anchorage Center, and with the appearance of another "hole", we started to climb.

The next few minutes were rather spooky. Both engine anti-ice caution lights illuminated, an indication that the systems which served to heat the air intake path were being thwarted by the minus 20 degree Celsius outside air temperature. Biting my lip as we passed 4,000 feet, I tried to take some consolation from the fact that the low temperature should prevent ice accretion. The fragility of our situation dawned on me with another rush of realization that we were hundreds of miles from an

airport served by navigational or approach aids, thousands of feet above a hostile ocean, dodging turbulence and icing, at night, in, quite parenthetically, a helicopter.

Now, I think we all recognize that helicopters have come a long way since their inception as a collection of aircraft parts flying in close formation. The pilots who fly these machines are, however, to quote ABC news commentator Harry Reasoner, "brooding introverts, anticipators of trouble who know that if something bad has not happened yet, it is just about to." They even sit in a weird manner, all hunched over the controls and squinting in the last great act of defiance. My evening prayers used to include Sikorsky Aircraft, General Electric, and Collins Radio. It's always been hard to accept the fact that the company whose engines kept me aloft for nearly 4,000 hours could also burn my toast in the morning.

As we topped the overcast and continued the climb to 8,000 feet, a sudden brilliant flash of light reflected off of the left side of the aircraft and into the cockpit. My eyes shot toward the engine instruments and I asked the flight mechanic to view the exterior for signs of a fire. I became totally confused as our troubleshooting began to rule out problems with the aircraft. The flashes of light seemed to be originating within the atmosphere to the west of us. Lightning was an almost unheard of phenomenon in Alaska, particularly in winter, and we had never seriously considered it.

At about this time, my buddy in the C-130 called and asked if we were enjoying the show. It turned out that, in a weird coincidence, a dormant volcano on Unimak Island had begun to erupt that night, sending a huge cloud of hot gases over thirty thousand feet into the super cold Alaskan sky. The resulting "light show", featuring lightning cloud-to-cloud, was spectacular; I have never forgiven my friend for his failure to forewarn me.

I guess I'll have to finish this tale, or you will be forced to conclude that we never made it. As we endured a quartering headwind and approached Unimak Island from the east-southeast, the distressed vessel's skipper seemed to gain confidence by the minute. He devised a plan to back into the wind and sea, steering the boat with differential power from his twin screws and maintaining a safe distance offshore until the arrival of a Coast Guard vessel at daybreak.

For my part, I had abandoned all hope of proceeding directly to the scene without first stopping to refuel at Cold Bay. After four hours of bucking headwinds, our fuel remaining was becoming critical.

The Flight Service Station at Cold Bay reported "ceiling indefinite, sky obscured, visibility less than one-eighth of a mile in a blowing snow, winds northwest at 35 knots gusting to 50". As we approached Deer Island, the initial approach fix for the back course localizer approach to runway 32, my co-pilot and I discussed our options. The back course approach would be quicker to execute, in view of our fuel state, since we were conveniently near the IAF. In addition, our let-down to minimums would be into the wind, permitting a slower groundspeed as we scanned for the runway environment in conditions of minimum visibility. A significant disadvantage lie in the fact that the nonprecision back course minimums were several hundred feet higher than those prescribed for the ILS to the opposing runway. Even at 200 feet AGL at the bottom of an ILS, we were hoping for a miracle. There would be insufficient fuel for multiple approaches. We opted for the approach by Anchorage Center.

As we approached the non-directional beacon in a descent to the initial approach altitude of 2,500 feet, we re-entered the clouds and began to bounce around again in the wake of nearby Pavlov volcano, which rose over 8,000 feet. Turning outbound over the Bering Sea, I slowed our airspeed to 80 knots and timed for an interminable five minutes to anticipate the awesome tailwind which we would acquire on the inbound course. The depicted left procedure turn progressed well until turning to intercept the final approach course.

My co-pilot suddenly asserted that I was flying a heading which would not result in the desired intercept. I stifled a mental scream of panic. While scanning steering information on the flight director and cross-checking the approach plate, I recited old adages to "turn to and through to center the CDI" and "the head of the needle will fall and the tail will rise." My actions were defensible, and my co-pilot conceded a perceptual error brought on, no doubt, by terrific fatigue and stress. To this day, I admire him for verbally expressing doubt about the progress of the approach, because a healthy skepticism in the cockpit can avert disaster.

I slowed the aircraft to 50 knots as we intercepted the localizer, but judged from the rate of descent required to remain on glide slope that our ground-speed would be much higher than the no-wind 80-knot approach speeds which I had frequently practiced. At minimums, the co-pilot announced "rabbit" in sight. I looked up briefly, but did not feel that the sequential high-intensity lights would be sufficient visual reference to grope for the runway in the snow. The low-fuel lights were blinking on in both main tanks, indicating 20 minutes of fuel remaining. A missed approach was out of the question. I dismissed earlier thoughts circling into the wind after "breaking out" at minimums. This was one of those instances where you never truly "break out"...the reason why CAT II and CAT III approaches were designed.

I told my co-pilot to stay visual and be ready to take the controls while continuing to fly the localizer and descending below minimums. As the helicopter passed through 100 feet AGL, the co-pilot stated that he could see one set of runway lights going by at a time and could gain visual reference. I passed control of the aircraft to him, but stayed on the guages, ready to take control back in the event he became disoriented. I talked him down in 10-foot increments on the radar altimeter until just prior to touchdown, when something totally unanticipated happened.

At about thirty feet or one-half rotor diameter above the ground, the helicopter enters ground effect and begins to create a "cushion" of air, which is normally expelled behind the craft in an air taxi or running landing situation at speeds above translational lift. In our case, a cloud of dry, powdery snow raced ahead of the helicopter and created a "white-out" situation due to the tailwind.

I shifted my scan from the radar altimeter to my side window, where I could see the runway lights going by one at a time and talked the co-pilot down the final few feet to a surprisingly smooth running landing. You can imagine the relief we felt as the aircraft was braked to a stop.

We encountered tremendous difficulty in taxiing toward the parking ramp, and only succeeded by using the lights of a cross runway to establish our location, and then relying on the airport diagram and intimate knowledge of the field to move cautiously a few hundred yards.

A short conversation with the C-130 ensued. He agreed to remain overhead the distressed vessel until fuel state required that he depart scene for Kodiak. A high-frequency radio at the Flight Service Station would enable us to monitor the vessel throughout the night in case the situation began to deteriorate and require us to hoist the fishermen from the craft. I told my buddy in the "herk" that only the most dire of circumstances could persuade me to launch from Cold Bay. I was not at all convinced we could give a repeat performance of the approach and landing which had just transpired. At this point, my young flight mechanic, who had been listening to the radio conversation, piped up on the ICS with the most astonishing statement I have ever heard. He said, and I quote, "Gee, Mr. Smith, if you can put me over that boat before daybreak, I can hoist all of those people and we'll all get the Distinguished Flying Cross." I began laughing hysterically and could barely accomplish the secure checklist. I still smile inwardly at any mention of the DFC.

The Coast Guard is a service steeped in tradition. We are the oldest continuous seagoing service, older even than the Navy, which was disbanded between the Revolutionary War and the War of 1812. As an amalgamation of the Revenue Cutter Service, the Lighthouse Service, and the Lifesaving Service, the Coast Guard acquired an unofficial motto which says, "You have to go out, but you don't have to come back." Pride, "can-do" attitude, mandated readiness, and a strongly perceived moral obligation have combined to present Coast Guard aviation management with an ethical dilemma over the past few years. Should we, or could we, ever say no in a situation where flight crew is likely to be subjected to the same risks as those whom we have set out to rescue? Of the many risk factors which characterize an elevated aviation accident potential, weather ranks alongside material failure as a random occurrence which cannot be programmed out through training or testing alone.

I would describe the average Coast Guard aviator as a "weather-wise" individual. Experience has taught us that weather is our greatest adversary and that we will often be called upon to fly when others do not. A sharp rise in Coast Guard aviation's accident fatality rate during the period from 1978 to and through 1981 is attributable to weather as a "factor".

For instance, one of our accident boards surmised that a night offshore helicopter crash which was fatal to all four crewmen was induced by pilot fatigue and resultant inadvertent tail rotor contact with the water during a prolonged hover over a distressed boat. You have to go back and ask yourself why the fisherman was distressed in the first place. Secondly, why had the pilot become a victim of acute short-term fatigue? The cause factor was most certainly environmental.

In another case, one of our single engine helicopters experienced an inflight engine failure during a violent gale which lashed the Pacific Northwest several years ago. The pilot successfully autorotated the aircraft to a crash landing in mountainous seas. The helicopter quickly rolled inverted, but all three crewmen egressed into the open ocean. Cast apart and driven over a mile to shore by the breakers, two of the three miraculously survived. Again, little doubt exists as to the environmental impact on this accident, although weather did not cause the engine to fail.

I would like to share with you a few of the facts surrounding a fatal aircraft accident with which I am intimately familiar. I was the member of a board which investigated the loss of an HH-3F helicopter 210 nautical miles southeast of Otis ANGB, Cape Cod, on the night of 18 February 1979. A Japanese longliner, the Kaisei Maru 18, reported a crewman suffering from head injuries and lacerations sustained during a fall earlier in the day. Medical evaluation was impeded by a troublesome language barrier and a lack of voice communications with the ship. Rescue Coordination Center Boston received CW transmission of phraseology from the International Code of Signals in morse code describing the patient's condition. After medical evacuation was decided upon, the vessel's exact position could not be established. Since the mission required that the HH-3F be flown to its maximum range, two aborted launches resulted from uncertainty over the position.

The helicopter departed the air station at 0312 local time on 18 February, arriving on scene in a hover at 0502. At approximately 0515, while engaged in an attempt to deliver a stokes litter to the Kaisei Maru 18, the helicopter suffered an apparent partial power loss and was ditched alongside the vessel. As the aircraft's rotor blades came in contact with the seas, the helicopter was wrenched violently into an inverted position. The hoist operator, who only moments before had been poised

in the cabin door, was able to extricate himself from the aircraft and cling to the nosewheel until the ship pulled him aboard. The pilot, co-pilot, radioman, and medic drowned during the attempted egress.

The following weather synopsis was submitted to the board by Detachment 6, 26th Weather Squadron, Pease AFB, NH:

During the weekend of 18-19 February, a cold polar air mass was situated over New England and the adjacent coastal waters. High pressure centered over Lake Huron, coupled with a low center situated in the Canadian Maritime Provinces, were producing strong northwesterly flow from the surface up through several thousand feet. This flow resulted in the advection of cold polar air from central Canada to several hundred miles offshore.

The high centered over Lake Huron moved eastward to northern New York State over the following twelve hours. No significant intensification was noted. During the same time period, the low located in the Canadian Maritimes drifted northeastward. The surface wind pattern remained essentially constant during this period, with the flow being from between 300 and 330 degrees. Although little weather data is available in the vicinity of the accident, the synoptic pattern suggests that northwest flow existed out to at least 300 NM offshore.

Based on available coastal wind data, the winds in the vicinity of the crash site were most probably between 25 to 40 knots, gusts included. Evidence to support this velocity can be found in the attached data. Nantucket light vessel reported winds of 320 degrees at 20 knots. Winds for the same time at Matinicus Rock were reported at 30 knots. An earlier ship report in position 44-20N/66-30W gave the wind as 360 degrees at 35 knots.

Coastal stations in New England were reporting clear skies. However, low overcast cloud conditions were observed over the ocean, based on satellite information. As the cold arctic air passed over the relatively warm waters offshore, an extensive area of stratocumulus clouds developed. Past experience has shown that this type of cloud formation has bases between 1,000 feet and 2,000 feet. Satellite pictures show the tops of this extensive overcast region to be approximately 4,000 feet. The area of cloud coverage extended from

just off Cape Cod to the eastward and from southwestern Nova Scotia southward to approximately 35 degrees north latitude.

Offshore surface visibilities between Cape Cod and the crash site are estimated to have been approximately 6 NM, with isolated areas having less than 1 NM in snow showers and snow squalls. Chatham (MA) radar reported a rather large area of radar echoes resulting from snow shower activity. A ship located at 44-20N/66-30W reported visibility at 1-1/4 NM in moderate snow with low overcast conditions."

As a matter of interest, this synopsis was corroborated time and again by witnesses who appeared before the board. The master of the Kaisei Maru 18 gave the following account:

The helicopter arrived in the vicinity at 0945 GMT, but actually proceeded to the location of a similar vessel approximately six miles away. (The master assumed this because he identified the helicopter as a fast-moving target on his surface radar). The wind was from the northwest at 20 knots and the seas from the same direction at 2.0 to 2.5 meters in height. The visibility varied in heavy snow showers, but the master knew that it was frequently at least two nautical miles, because later he could see the other fishing boat (to which the helicopter had originally flown) and confirmed its range on radar. The snow was of powdery consistency. Visibility was restricted by fog forming just above the sea surface. Free air temperature was measured at minus two degrees Celsius, and sea water surface temperature at 13.2 degrees Celsius. The barometer read 1040.5 millibars.

Of particular interest to the board was the pilot's decision to fill all of the helicopter's fuel tanks to the maximum before departing on the mission. With the design of the helicopter's fuel system in mind, a full fuel load would, under any set of environmental conditions, result in the aircraft being above the maximum certificated takeoff gross weight. Since the helicopter had been fueled from a JP-4 truck which had gradually "cold-soaked" to the minus fifteen degrees Celsius temperature which existed on Cape Cod, the aircraft was a whopping 1200 pounds heavier than permitted at takeoff. Although not a cause factor in the accident, this "additional finding" highlighted the importance this pilot attached to fuel sufficiency when contemplating a long offshore mission, particularly one which featured uncertainty of the ves-

sel's position and a headwind component on the return leg.

When a few of my fellow pilots learned that I would be attending your workshop, they said, "Hey, tell them we need more information on the weather features between the sea surface and, let's say, 2,000 feet." The truth is, most Coast Guard pilots have a pretty good mental picture of what to expect at the interface between either the sea or land, given a certain set of parameters. What is needed is a graphic portrayal of these conditions for decision-makers who employ aviation resources. Why should the pilot be forced to "poke his nose in it", instead?

As stated in the book Weather Flying, weather is a local phenomenon. Local knowledge and experience should be combined with a detailed forecast to produce a better mental "picture" of the weather. The intent is not for the pilot or dispatcher to exploit advantages resulting from improved weather sense; on the contrary, a conservative decision can be formulated around this wariness. I remember years ago ferrying helicopters across west Texas on the "southern ferry route". Approximately 150 miles east of El Paso, commanding a view of the southernmost portion of the continental divide, is Guadalupe Pass. Even though I had never experienced turbulence in a helicopter, the "old hands" cautioned us never to cross Guadalupe if the winds at the RCO were indicating higher than 15 knots. It seemed like reasonable advice, possibly written in blood, and I would observe it today without question.

We should do away with "special VFR" for all except aircraft involved in emergency missions. I'm sorry, ladies and gentlemen, but if you don't have an instrument ticket, you shouldn't be out there flailing around in IMC. Yes, to avoid inconvenience, a great number of precision approach aids will have to be established at small airports around the country. And too, positive control will have to be exercised, if not through additional control towers, then at least remotely. All of this will tax the air traffic control system, but when the ceilings come down and visibility shrinks, we can't seriously be expected to "see and avoid" each other (and ground obstacles) while squeezed below 1,200 feet AGL.

Circling approaches are a sucker play, particularly in approach category C, D, and E aircraft. Have

you ever tried to maintain circling altitude and airspeed while fighting the effects of vertigo, turbulence, precipitation, and the like without exceeding 30 degrees angle of bank? Have you really managed to keep the runway environment in sight? Can you really expect the bottom of an overcast to be perfectly constant in altitude?

All operations should cease at an airport which is experiencing low-level wind shear. I learned my lesson over the Gulf of Alaska while penetrating "roll clouds" near the base of an imbedded thunderstorm at 500 feet. Fortunately, the aircraft encountered a severe updraft resulting in a climb of 2,000 feet per minute with collective pitch at a minimum. The aircraft yawed 180 degrees to the right with full left pedal applied. My first Operations Officer, CDR Frank Silvia, was lost on Eastern Airlines Flight 66 when it encountered LLWS years ago in the first commercial accident attributable to this phenomenon. Let's recognize it.

Pilots will never probably fully appreciate the forces of nature or the potential for destruction. Indeed, in this computer age of digital electronics, there appears to be a greater impatience with weather than ever before. Pilots want to graph it, map it,

electronically dissect it, display it in pulsating colors, and then top it. They surely don't want to be inconvenienced by it.

I recall launching out of Cape Cod to search for a man overboard near Boston during one of the worst summer squall lines to traverse the New England coast in years. After level-off at 1,000 feet over Cape Cod Bay, we were surrounded by lightning in all quadrants. The radar was totally useless, since the intensity of nearby cells effectively attenuated radar signals at a greater range. The best we could do was hang on. At one point, my radioman asked me what would happen if lightning struck the helicopter. I remembered hearing about a Kaman HH-43 helicopter which disintegrated after a lightning strike near MacDill AFB many years ago. I recalled also sitting through a training session where an older, more experienced, pilot described a helicopter struck by lightning as a giant arc welder. The point is, I still have absolutely no idea what happens when a helicopter is struck by lightning, but the thought is very unsettling. I give thunderstorms a wide berth for that, and many other, reasons. I told the radioman our static discharge wicks on the horizontal stabilizer could handle it. Thank you.